

tapped with a V-cut gave much less than others with a vertical cut, the greater yield, however, being partly due to the fact that the length of the incision in the latter case is greater than in the former. No advantage was gained from the use of four cuts daily instead of two. The effects of nitrate of soda on the flow of latex have also been studied. Fertilisers are in use in rubber plantations for increasing the growth and vigour of the trees, and it now appears that nitrate of soda also increases the flow of latex. In one experiment a group of five trees yielded 0.9 oz. of dry rubber in three days before applying the nitrate, and 1.3 oz. in the three days following its application, each tree receiving half a pound of the fertiliser. How far the method is economical has yet to be determined. All these experiments were made with Ceara rubber trees.

A number of analyses have been made of the latex from the plants growing in the Botanic Gardens, Singapore. A thirty-two-year-old tree of *Hevea brasiliensis* gave at one tapping 27 fluid ounces of latex, of which 61.08 per cent. was water, 2.3 per cent. serum solids, mainly organic matter, and 36.29 per cent. coagulum was obtained by means of acetic acid. Almost the whole of the coagulum was rubber, only a little resin being present. From another variety, *Landolphia Heudelotii*, the dry rubber yielded 89.5 per cent. of pure rubber and 10.5 per cent. of resin.

The question of preparing the rubber after the latex is obtained is of very great importance. Fine hard Pará rubber containing 10 or 20 per cent. of moisture has a higher relative value than the practically pure sheets from the East. It is considered that the difference in value is partly due to the difference in method of dealing with the latex, and a process has recently been devised in which the latex is treated with smoke, creosote, and acetic acid, so that it may coagulate under conditions comparable with those obtaining in Brazil. In this process, steam at a pressure of 30 or 35 lb., mixed with the fumes from strongly heated green palm leaves or other green parts of trees, is forced by a steam injector into tanks containing the strained latex. In about ten minutes the caoutchouc globules coagulate and rise to the surface.

An incidental problem is the most economical way of dealing with a rubber plantation until the trees come into yielding. A Bulletin from the Federated Malay States Department of Agriculture sets out the advantages of *Coffee robusta*. This plant, discovered wild in the Congo region in 1898, grows more rapidly and fruits sooner than the well-known *C. liberica*. When grown in rubber plantations, it yields a small return in the second year and a good return in the third and following years, but after five years it competes so seriously with the rubber that it must be cut out.

THE MINERAL RESOURCES OF THE UNITED STATES.¹

IN response to the latest of the periodic scares of impending bankruptcy due to the exhaustion of fuel, ore, or soil, the Geological Survey of the United States has been instructed to estimate the national economic mineral resources. Its report (Bull. No. 394), dealing with quantities on a continental scale, may excite the envy of the single countries of Europe; and though the factors are uncertain, the available supplies of most minerals are sufficient to render political restriction of output unnecessary. Thus, in the case of coal, Pennsylvania is known to have enough to

last for 492 years at the rate at which the material was being exhausted in 1907. Ohio has only used 0.9 per cent. of its proved supplies, and at the rate of production in 1907 they will last for two thousand years. In Maryland the coal will last for another 948 years. Mr. Gannet, in a general summary of the extent of the coal reserves, estimates that only one-third of one per cent. of the known and easily accessible supply was mined during the last century.

In regard to the other fuels, the future is less assured for natural gas and petroleum. Assuming that petroleum generally comes from beds 5 feet in thickness, and with 10 per cent. of pore space, an acre would yield 5000 barrels of 42 gallons each. The extent of proved oil land in the States is enormous. Thus, it is expected that the State of California alone will supply 5,000,000,000 barrels. There has been a steady increase in the yield from 2000 barrels in 1859 to 166,000,000 in 1907. The yield, however, has fallen in many of the States, including Pennsylvania and New York, where, according to Dr. Day, it will be negligible ten years hence. The yield has fallen in Ohio, West Virginia, Kentucky, Colorado, Indiana, Texas, and Louisiana; but it has risen in California, Illinois, and Kansas. Dr. Day concludes that if the present production is not increased, the available supply will last the States for ninety years; but if the demand increases as rapidly as during the past few years, the end may come in 1935. He therefore suggests that oil should be limited to the purposes for which it is indispensable, such as lighting in scattered houses and as a lubricant. As half a pint of oil is used in an engine for every ton of coal burnt, the exhaustion of cheap lubricants would be an industrial disaster.

Dr. Day reports on the supplies of natural gas. In most cases the wells have a short life, and 1,000,000,000 cubic feet are still being wasted daily. Much of the waste is said to be unavoidable, as the gas cannot be saved economically from wells from which oil is being pumped; but legislation to prevent unnecessary waste is recommended. After a well has ceased to yield gas under high pressure, a supply can be obtained for years by pumping.

A mineral famine in the United States is most often predicted for iron, as the ores of present value are restricted in depth. The estimates compiled by Mr. Hayes show that there is no immediate fear of the end of the Iron age. He estimates the ore supply now available in the United States at 4,788,000,000 tons. If the present rate of increase in the consumption of iron be maintained, this quantity would, however, be used during the next thirty years; so that before 1940 American iron production would have begun to decline, and low-grade ores not included in the estimate quoted would have to be used. Mr. Hayes, however, concludes that the factors are so indeterminable that any further prediction as to the date of exhaustion of American iron ores "is so uncertain as to be wholly unprofitable and unwarranted."

The United States have been one of the leading producers of phosphates since 1867, and nearly half the phosphate manufactured is exported for the benefit of the exhausted soils of Europe. At the present rate of increase, the supply will only last twenty-five years, and Mr. van Horn, the author of the report on phosphates, therefore recommends that future leases should only be granted on condition that the phosphate shall be used in the States.

That predictions of a coal famine in America are idle may be realised from the reports on the little-known coalfields of the western and central States in Bulletin 341. It is edited by Mr. Marius R. Campbell, and includes twenty-two separate memoirs and a bibliography. The coals are partly Eocene, belonging especially to the Fort Union Series, and partly Cretaceous, coming mainly from the Mesaverde Series. The Sentinel Butte Field in North Dakota and Montana yields an Eocene lignite, of which 33,000,000,000 tons are available within a thousand feet of the surface, and in seams 3 feet or more in thickness. The coal yields excellent producer gas, and can be made into briquettes without the addition of any binder. The coal contains 34 to 45 per cent. of water, and after it is air-dried its calorific efficiency is from 8200 to 8600 British thermal units. From Sentinel Butte a series of coal fields extends south-westward through Montana, Utah, Colorado, Nevada, and New Mexico. The Eocene coals become less important, and the Cretaceous coals more important to the

United States Geological Survey. Bull. 341.—M. R. Campbell. Contributions to Economic Geology, 1907. Part II, Coal and Lignite. Pp. 444, xxv pls., 7 figs. (Washington: Government Printing Office, 1903.)

Bull. 347.—F. E. Wright and C. W. Wright. The Ketchikan and Wrangell Mining Districts, Alaska. Pp. 210+vi, xii pls., 23 figs. (Washington: Government Printing Office, 1908.)

Bull. 374.—F. H. Moffit and A. G. Madsen. Mineral Resources of the Kotsina-Chitina Region, Alaska. Pp. 103, x. pls., 9 figs. (Washington: Government Printing Office, 1909.)

Bull. 379.—A. H. Brooks and others. Mineral Resources of Alaska, Report on Progress of Investigations in 1908. Pp. 418, x pls., 21 figs. (Washington: Government Printing Office, 1909.)

Bull. 380.—C. W. Hayes and W. Lindgren. Contributions to Economic Geology, 1908. Part I, Metals and Non-metals, except Fuels. Pp. 406, ii pls., 32 figs. (Washington: Government Printing Office, 1909.)

Bull. 394.—Papers on the Conservation of Mineral Resources. Reprinted from Report of the National Conservation Commission, February, 1909. Pp. 214, vii pls., 2 figs. (Washington: Government Printing Office, 1909.)

south-west. Thus the Cretaceous coals at Crazy Mountain, Montana, are too thin to be mined, except for local use; but at Lewiston, Montana, the Lower Cretaceous coal from the Kootenai formation is of great value, though high in sulphur; the Grand Mesa field in Colorado has an estimated supply of 15,000,000,000 tons of Mesaverde coal, of a calorific value of from 8600 to 13,600 thermal units.

A second Bulletin (No. 380), "Contributions to Economic Geology, 1908," deals with minerals except fuels. Mr. C. W. Hayes has superintended the preparation of the reports on the non-metals and iron ores, and Mr. W. Lindgren those on the rest. The Bulletin consists of twenty-five papers and numerous bibliographies. Some of the reports are based upon only a few hours' or a day's visit, but others are preliminary reports based upon a longer study. J. S. Diller and G. F. Kay describe the Grants Pass goldfield in Oregon, which is one of those frequent and disappointing fields where the gold is very widely distributed through innumerable small veins and veinlets; the absence of well-defined lodes is unfavourable to profitable mining, until some clue be discovered to the distribution of the richer patches. The ores are found in association with greenstones and granodiorites intruded into altered sediments. The placer deposits are widely scattered, and are worked by many small mines, employing from three to five men each. Some of the placers are Cretaceous shore deposits.

Mr. F. L. Hess reports upon the tin, wolfram, and tantalum deposits of South Dakota. Tin is so scarce in the United States that much interest was excited by its discovery in pegmatite dykes traversing the Algonkian schists at Harney Peak. Assays showed the presence of up to 6 per cent. of tin, and the Harney Peak Tin Company was established to work the deposits on a big scale. Three million dollars of English money, in addition to some American, was spent in the venture, and Mr. Hess tells us that the 5000 tons of ore put through the mill yielded only 0.25 per cent. of tin. The tin cost more than its weight of gold. This failure is, perhaps, not surprising, as pegmatite dykes have never been found to pay as tin ores except on a small scale. The wolfram ores of the same locality are known from the descriptions of Mr. J. D. Irving, and though Mr. Hess does not altogether agree with his theoretical conclusions, he remarks that Mr. Irving's prediction as to the limited economic value of the deposits has been fully justified. This wolfram ore is of some interest, as it occurs as a replacement of dolomite and was introduced by solutions rising along vertical fractures.

Of the four papers in this Bulletin dealing with iron ores, one of the most interesting is by Mr. E. C. Harder, on the ores of the Appalachian region in Virginia. Some of the ores occur in the pre-Cambrian schists and crystalline rocks of the country at the eastern foot of the Alleghany Mountains; but the ores are not commercially important. They, however, include the interesting titaniferous magnetites of the Blue Ridge, which have been formed as segregations in a basic syenite (unakite); and the truly magmatic origin of these small bunches of ore is shown by the many included specks of minerals belonging to the enclosing rocks. The more important ores occur in the Palæozoic rocks of the Appalachian plateau, including "brown ores" of three distinct origins. They are "mountain ores" associated with Lower Cambrian quartzites, "valley ores" found in residual material formed from Cambrian limestone, and the Oriskany ores, which occur as replacements in the Silurian Lewistown limestone.

The manganese ores of the United States have been studied by Mr. Harder, who promises a special bulletin upon them. The ores are widely distributed, but are not much mined, since they usually occur in pockets of not exceeding 25,000 tons, and cannot compete with the imports.

Among reports on the non-metallic minerals is a short note on the mica deposits of southern Dakota, by Mr. D. B. Sterrett. The mica is found in pegmatites, which are sometimes intrusive dykes and sometimes veins due to pneumatolytic action. The two types pass imperceptibly into one another. The supply of sheet mica for lamps and furnace doors exceeds the demand, and most of the mica obtained is employed for the manufacture of electric

machinery. There is a short report by E. G. Woodrow on the sulphur deposits near Thermopolis, Wyoming; the sulphur is deposited by hot springs, where the water comes in contact with limestone. The sulphur is deposited as crystals, and also as masses replacing the limestone.

Mr. Matson contributes some notes on the clays of Florida, and describes the ball clays, which are usually described as kaolin, as they are white burning, and can be used for either porcelain or white earthenware. As they are sedimentary, Mr. Matson seems unnecessarily doubtful as to whether they can be included in kaolin.

Bulletin No. 374 describes the mineral resources of the Kotsina-Chitina region of Alaska, by F. H. Moffit and A. G. Maddren. The name Chitina means "copper river," and copper is the most promising mineral of the district, though it has not yet been proved to occur in conditions under which it can be profitably mined. The district also contains some coal and alluvial gold, which has been worked since 1902. The copper is mostly found in the lower part of the Triassic Chitistone limestone, where it rests on the Nikolai greenstone, a series of basaltic lava flows, from which the copper is thought to have been derived.

The investigations on the general mineral resources of Alaska made in 1908 are reported in Bulletin 379, in a series of nineteen papers, edited by Mr. A. H. Brooks. The mining industry as a whole suffered a decline in output during that year owing to the diminished yield of copper. Gold is still the main source of wealth, though the yield fell slightly below that of 1906. Four-fifths of the supply is alluvial, and the cost of working the placers is so heavy that only the richest are worked. The lode mines, on the other hand, are low grade, the most important being those of the Alaska Treadwell group. Its ore yields only 2.3 dollars of gold per ton, but, owing to the large quantity and easy methods of mining, it can be worked at a cost of one dollar a ton. In spite of local predictions, dredges have already proved successful, and their use must add greatly to the available mineral wealth of the district. The most interesting placer deposits are those at Nome, on the Seward Peninsula, where the famous Third Beach, discovered in 1905, is still being worked. Alaskan shore placers are at present the most important that are being worked anywhere for gold. The report by Moffit and Knopf on the Nabesma-White River district shows that the copper there occurs in Carboniferous basaltic amygdaloids and in limestone along the contact with some intrusive diorites; but the fabulously rich copper deposits reported have not yet been found.

J. W. G.

AIRSHIP FLIGHTS.

FOR some time public attention has been directed chiefly upon the records achieved by aeroplanes. Two airship flights undertaken during the past few days serve to illustrate what may be accomplished by dirigible balloons. On October 15, at about 8 a.m., Mr. Walter Wellman left Atlantic City in his gigantic airship *America* with the object of voyaging to Europe; and on the following day the frameless airship *Clément-Bayard No. 2* travelled from Lamotte-Breuil by Compiègne to Wormwood Scrubbs—a distance of nearly 260 miles—in six hours.

The *Clément-Bayard No. 2* is 251 feet long, and its greatest diameter 44 feet 4 inches. The *Times* gives the following particulars of the construction of this airship.

Inside the bag there are two compensating air balloons which can be filled separately. The car, 26 feet 3 inches beneath the envelope, is 147 feet 5 inches long. The stern is provided with a keel to preserve stability. The metallic framework is composed of triangular steel rafters, except in the portion occupied by the motors, crew, and passengers, where they are quadrangular. At the hind extremity this framework takes a turn upwards to support the equilibrator, a large triplane-like apparatus with eight square compartments resembling the main cell of a Voisin aeroplane, controlling ascent and descent. The equilibrator, comprising the rudder, composed of two mobile planes on vertical axes at either end of the triplane, is worked by an irreversible mechanism. There are two propellers driven by two 120 horse-power *Clément-Bayard*